Computational Numerical Statistics
Assignment 1

Migla Miskinyte Reis

30.09.20

Exercise 2. (0.1 points) **Points:** _____

Consider the random variable $X \sim tn$.

(a) Define in R a function called `pdf.t`(x, df) that corresponds to the p.d.f. of X and use it to compute `pdf.t`$(1, 3)$. Compare the result with the one given by the built-in R function `d.t`().

```
pdf.t<-function(x,n){
  gamma((n+1)/2)/(sqrt(n*pi)*gamma(n/2))*(1 + x^2/n)^-((n+1)/2) #my function
}

pdf.t(1,3)                                                    #my calculations
```

```
## [1] 0.2067483
```

```
dt(1,3)                                                       #equals to built-in functions
```

```
## [1] 0.2067483
```

(b) Confirm that $\int_{-\infty}^{+\infty}$ `pdf.dt`$(x)dx = 1$.

```
pdf.t1 = function(x) {
  return(pdf.t(x, 1))
  }                                #I fixed my degrees of freedom to 1

integrate(pdf.t1, lower = -Inf, upper=Inf)    #integrate for x
```

```
## 1 with absolute error < 1.6e-10
```

(c) Use R built-in functions to construct the usual tn table with $n = 1,\ldots,31$.

```
alpha<-c(0.1,0.05,0.025,0.01,0.005, 0.001, 0.0005) # make a vector for t distribution probabilities (al
n<-c(seq(1:31))                          # n is my degree of freedom (df)
tn_table<-sapply((1-alpha),function(x) qt(x, df=n)) #using built-in qt quantile function
colnames(tn_table)<-alpha
print(tn_table)
```

```
##            0.1     0.05     0.025      0.01     0.005      0.001       5e-04
##  [1,] 3.077684 6.313752 12.706205 31.820516 63.656741 318.308839 636.619249
##  [2,] 1.885618 2.919986  4.302653  6.964557  9.924843  22.327125  31.599055
##  [3,] 1.637744 2.353363  3.182446  4.540703  5.840909  10.214532  12.923979
##  [4,] 1.533206 2.131847  2.776445  3.746947  4.604095   7.173182   8.610302
##  [5,] 1.475884 2.015048  2.570582  3.364930  4.032143   5.893430   6.868827
##  [6,] 1.439756 1.943180  2.446912  3.142668  3.707428   5.207626   5.958816
##  [7,] 1.414924 1.894579  2.364624  2.997952  3.499483   4.785290   5.407883
##  [8,] 1.396815 1.859548  2.306004  2.896459  3.355387   4.500791   5.041305
##  [9,] 1.383029 1.833113  2.262157  2.821438  3.249836   4.296806   4.780913
## [10,] 1.372184 1.812461  2.228139  2.763769  3.169273   4.143700   4.586894
## [11,] 1.363430 1.795885  2.200985  2.718079  3.105807   4.024701   4.436979
## [12,] 1.356217 1.782288  2.178813  2.680998  3.054540   3.929633   4.317791
## [13,] 1.350171 1.770933  2.160369  2.650309  3.012276   3.851982   4.220832
## [14,] 1.345030 1.761310  2.144787  2.624494  2.976843   3.787390   4.140454
## [15,] 1.340606 1.753050  2.131450  2.602480  2.946713   3.732834   4.072765
## [16,] 1.336757 1.745884  2.119905  2.583487  2.920782   3.686155   4.014996
## [17,] 1.333379 1.739607  2.109816  2.566934  2.898231   3.645767   3.965126
## [18,] 1.330391 1.734064  2.100922  2.552380  2.878440   3.610485   3.921646
## [19,] 1.327728 1.729133  2.093024  2.539483  2.860935   3.579400   3.883406
## [20,] 1.325341 1.724718  2.085963  2.527977  2.845340   3.551808   3.849516
## [21,] 1.323188 1.720743  2.079614  2.517648  2.831360   3.527154   3.819277
## [22,] 1.321237 1.717144  2.073873  2.508325  2.818756   3.504992   3.792131
## [23,] 1.319460 1.713872  2.068658  2.499867  2.807336   3.484964   3.767627
## [24,] 1.317836 1.710882  2.063899  2.492159  2.796940   3.466777   3.745399
## [25,] 1.316345 1.708141  2.059539  2.485107  2.787436   3.450189   3.725144
## [26,] 1.314972 1.705618  2.055529  2.478630  2.778715   3.434997   3.706612
## [27,] 1.313703 1.703288  2.051831  2.472660  2.770683   3.421034   3.689592
## [28,] 1.312527 1.701131  2.048407  2.467140  2.763262   3.408155   3.673906
## [29,] 1.311434 1.699127  2.045230  2.462021  2.756386   3.396240   3.659405
## [30,] 1.310415 1.697261  2.042272  2.457262  2.749996   3.385185   3.645959
## [31,] 1.309464 1.695519  2.039513  2.452824  2.744042   3.374899   3.633456
```